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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the polycarbonate resin molding material for optics and optical disk substrate which can maintain high dependability over a long period of time, and can raise substrate productivity.

[0002]

[Description of the Prior Art] As an optical disk which performs informational record and playback by the exposure of a laser beam, a digital audio disc (the so-called compact disk), an optical videodisk (the so-called laser disk), various postscript mold disks, the magneto-optic disk, the phase change disk, etc. are put in practical use. Among these, a compact disk and a laser disk are optical disks of the mold only for playbacks (Read Only Memory:ROM). The pit corresponding to [ in these optical disks ] an information signal to a transparence substrate top is formed in a concavo-convex configuration, and aluminum reflecting layer is produced by the thickness of 40nm or more at a this top. In such an optical disk, an information signal is reproduced by detecting the reflection factor change by optical interference produced in a pit.

[0003] On the other hand, a write once optical disk is an optical disk of R (Recordable) mold which can write in arbitration information by the user, and a magneto-optic disk and a phase change mold disk are optical disks of the RAM (Random Access Memory) mold which can write in repeat arbitration information. That is, an R form optical disk consists of recording layers of the postscript mold with which an optical property changes with the exposures of a laser beam irreversibly, or a concavo-convex configuration is formed on a transparence substrate. While heating by the exposure of a laser beam decomposes as this recording layer, for example and that optical constant changes, the organic coloring matter of the cyanine system which produces deformation of a substrate by the volume change, a phthalocyanine system, and an azo system etc. is used.

[0004] A magneto-optic disk is an optical disk of a rewritable mold which can repeat informational writing and informational elimination and can perform them by the user, and the perpendicular magnetic anisotropy films which have the magneto-optical effect (for example, Kerr effect) of a Tb-Fe-Co amorphous alloy thin film etc. on a transparence substrate are formed, and it is constituted. In this magneto-optic disk, a record pit is formed by magnetizing the minute field of perpendicular magnetic anisotropy films facing up or downward corresponding to an information signal. And an information signal is reproduced using angle-of-rotation  $\theta_{\text{K}}$  (car angle of rotation) of the linearly polarized light in the reflected light changing with sense of magnetization of perpendicular magnetic anisotropy films.

[0005] A phase change disk is a disk of a rewritable mold as well as a magneto-optic disk, for example, a crystallized state is presented by the initial state, and the germanium-Sb-Te phase change ingredient which changes a phase change into an amorphous condition by a laser beam being irradiated is used. By this recording layer, by carrying out the phase change of the

minute field corresponding to an information signal, a record pit is formed and an information signal is reproduced by detecting reflection factor change with the amorphous part equivalent to a pit, and the other crystalline region.

[0006] By such a magneto-optic disk and a phase change disk, the both sides of a recording layer are put by the transparent dielectric layer for the purpose of buildup of the signal modulation factor by antioxidizing and multiplex interference of a recording layer, and four layer systems which carried out the laminating of the aluminum reflecting layer on it further are taken in many cases. In addition, as a dielectric layer, a silicon nitride film, the Zn-SiO<sub>2</sub> hybrid film, etc. are used. A digital versatile disc (DVD) has come [ by the way, / examination for using such an optical disk as an object for digital image record recently is performed briskly, and / as such an optical disk ] to be developed.

[0007] Considering as the same diameter of 120mm as CD, this DVD records the image information equivalent to film 1 duty, and is made as [ reproduce / it / by about the same image quality as the present television ]. Here, in order to record such image information on an optical disk, one 6 to 8 times the storage capacity of CD is needed. For this reason, while short-wavelength-izing laser wavelength with 635-650nm to 780nm in CD, he contracts the shortest record mark length of a track pitch or a pit by DVD, and is trying to raise recording density with it by increasing the numerical aperture NA of an objective lens to 0.52 or 0.6 to 0.45 in CD.

[0008] Among these, buildup of the numerical aperture NA of an objective lens will make small the permissible dose to the camber of a disk substrate. For this reason, a laser beam shortens distance which passes a disk substrate, and he is trying to compensate the permissible dose to curvature with DVD by making thickness of a substrate thin with 0.6mm to 1.2mm of CD (Nikkei electronics February 27, 1995 issue No.630). And in order to compensate lowering of the disk reinforcement by making a substrate thin further, the so-called lamination structure which sticks a substrate further on the recording layer formed on the substrate is taken so that it may be indicated by JP,6-274940,A. both [ in addition, ] the recording layer of the ROM mold used with an above-mentioned veneer configuration as a recording layer of a lamination optical disk the recording layer of an R form and the recording layer of a RAM mold -- although -- it is employable.

[0009] Furthermore, there are an one side lamination optical disk only using the field of the one side and a double-sided mold lamination optical disk using the field of both sides as lamination optical disk. Many polycarbonate resin excellent in a moldability, reinforcement, light transmission, moisture resistance, etc. is used for the above disk substrates for optics.

[0010] However, it is easy to hydrolyze the polycarbonate resin which has the property which was excellent in this way an elevated temperature and under highly humid, and there is a fault of being easy to cause lowering of molecular weight, lowering of impact strength, etc.

Moreover, when it was left a rear-spring-supporter elevated temperature and under highly humid at the long period of time, the minute flake occurred in the substrate, and there was a fault that dependability was spoiled over a long period of time.

[0011] On the other hand, the demand to a substrate productivity drive is also increasing with the spread of optical disks in recent years. If it fabricates by resin containing various volatile constituents as an impurity for a long period of time, various components will deposit on metal mold, a stamper, etc., and it will be connected to aggravation of substrate properties, such as optics and a mechanical characteristic. Moreover, with shaping of long duration, the problem that said various substrate properties get worse is also generated. For this reason, in order to perform washing of metal mold or a stamper, continuous molding had to be suspended, and it had had the adverse effect on the productivity drive.

[0012]

[Problem(s) to be Solved by the Invention] As a result of making this invention in view of the above-mentioned trouble and repeating research wholeheartedly about this trouble, by

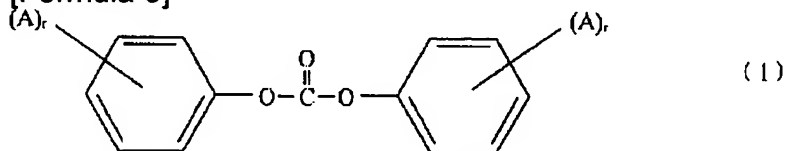
reducing the content of the matter expressed with the matter and formula (2) which are expressed with the following formula in polycarbonate resin (1), degradation of the substrate which consists of polycarbonate resin was controlled very effectively, and it found out that the disk for optics which can maintain high dependability over a long period of time was obtained. Moreover, reduction of the matter expressed with the matter and formula (2) which are expressed with these formulas (1) led also to reduction of a volatile constituent simultaneously, and it also found it that the polycarbonate resin molding material for optics whose substrate productivity improved, and an optical disk substrate are obtained.

[0013]

[Means for Solving the Problem] That is, this invention is an optical disk substrate with which the content of the matter expressed with the following formula (1) consists of the polycarbonate resin molding material for optics and it which consist of polycarbonate resin whose content of the matter expressed with 50 ppm or less and a formula (2) is 50 ppm or less.

[0014]

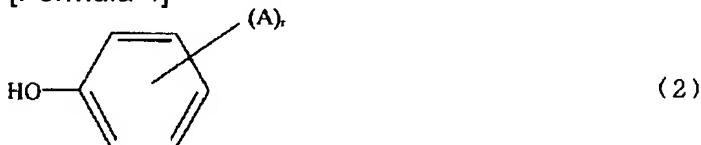
[Formula 3]



[0015] [A is a hydrogen atom, an alkyl group, a phenyl alkyl group, or an aliphatic series ester group among a formula, and r is the integer of 1-5.]

[0016]

[Formula 4]



[0017] [A is a hydrogen atom, an alkyl group, a phenyl alkyl group, or an aliphatic series ester group among a formula, and r is the integer of 1-5.]

[0018] In this invention CD-R, CD-RW, MO, a digital videodisc, The substrate of the optical disk of the digital versatile disc (DVD) represented with DVD-ROM, DVD-audio, DVD-R, DVD-RAM, etc., In order to acquire dependability sufficient as a disk substrate especially used for high density optical disks, such as a substrate of DVD, and to raise substrate productivity It is required for the content of the matter by which the content of the matter expressed with the formula (1) in the molding material (aromatic series polycarbonate resin) offered in order to fabricate this substrate is expressed with 50 ppm or less and a formula (2) to be 50 ppm or less. although A is a hydrogen atom, an alkyl group, or an aliphatic series ester group among a formula (1) and (2) here -- desirable -- the alkyl group of carbon numbers 1-9, or a phenyl alkyl group (the carbon number of an alkyl part is 1-9) -- it is -- r -- the integer of 1-5 -- it is the integer of 1-3 preferably. Although these separate at the time of the thing which is added as an end halt agent at the time of the polymerization reaction of polycarbonate resin, and remains in resin as a simple substance, and a polymerization reaction and remain in resin as a simple substance, they show a content.

[0019] When the content of the matter by which the content of the matter expressed with a formula (1) is expressed with 50 ppm or less and a formula (2) is stopped by 50 ppm or less, generating of the flake where a substrate is minute, and the count of washing of metal mold or a stamper can be pressed down to the minimum. When the ingredient with which the content of the matter expressed with the content or formula (2) of the matter expressed with a formula

(1) exceeds 50 ppm is used, such sufficient dependability and substrate productivity are not acquired.

[0020] In addition, the content of the matter expressed with a formula (1) can acquire effectiveness with preferably positive still more preferably it being [ 50 ppm or less / 30 ppm or less ] 20 ppm or less. 10 ppm or less are the most desirable. Moreover, the content of the matter expressed with a formula (2) can acquire effectiveness with preferably positive still more preferably it being [ 50 ppm or less / 40 ppm or less ] 30 ppm or less. 15 ppm or less are the most desirable.

[0021] The polycarbonate resin used by this invention makes a dihydric phenol and a carbonate precursor usually react with interfacial polymerization or scorification, and is obtained. As a typical example of the dihydric phenol used here Hydroquinone, resorcinol, 4, and 4'-dihydroxydiphenyl, Screw (4-hydroxyphenyl) methane, screw {(4-hydroxy - 3, 5-dimethyl) phenyl} methane, 1 and 1-screw (4-hydroxyphenyl) ethane, 1, and 1-screw (4-hydroxyphenyl)-1-phenyl ethane, 2 and 2-screw (4-hydroxyphenyl) propane (common-name bisphenol A), 2 and 2-screw {(4-hydroxy-3-methyl) phenyl} propane, 2 and 2-screw {(4-hydroxy - 3, 5-dimethyl) phenyl} propane, 2 and 2-screw {(3, 5-dibromo-4-hydroxy) phenyl} propane, 2 and 2-screw {(3-isopropyl-4-hydroxy) phenyl} propane, 2 and 2-screw {(4-hydroxy-3-phenyl) phenyl} propane, 2 and 2-screw (4-hydroxyphenyl) butane, 2, and 2-screw (4-hydroxyphenyl)-3-methyl butane, The 2 and 2-screw (4-hydroxyphenyl) -3, 3-dimethyl butane, 2, 4-screw (4-hydroxyphenyl)-2-methyl-butane, 2, and 2-screw (4-hydroxyphenyl) pentane, 2 and 2-screw (4-hydroxyphenyl)-4-methyl pentane, 1, and 1-screw (4-hydroxyphenyl) cyclohexane, A 1 and 1-screw (4-hydroxyphenyl)-4-isopropyl cyclohexane, 1 and 1-screw (4-hydroxyphenyl) - 3, 3, a 5-trimethyl cyclohexane, 9 and 9-screw (4-hydroxyphenyl) fluorene, 9, and 9-screw {(4-hydroxy-3-methyl) phenyl} fluorene, alpha and alpha'-screw (4-hydroxyphenyl)-o-diisopropylbenzene, alpha and alpha'-screw (4-hydroxyphenyl)-m-diisopropylbenzene, alpha and alpha'-screw (4-hydroxyphenyl)-p-diisopropylbenzene, 1, the 3-screw (4-hydroxyphenyl) -5, 7-dimethyl adamantane, A - dihydroxy diphenylsulfone, and 4 and 4 '4, 4'-dihydroxydiphenyl sulfoxide, - dihydroxy diphenyl ether, and - dihydroxydiphenyl sulfide, and 4 and 4 '4, 4'-dihydroxy diphenyl ketone, 4, and 4 '4, 4'-dihydroxydiphenyl ester etc. is raised, and these can mix and use independent or two sorts or more.

[0022] Especially Bisphenol A, 2, and 2-screw {(4-hydroxy-3-methyl) phenyl} propane, 2 and 2-screw (4-hydroxyphenyl) butane, 2, and 2-screw (4-hydroxyphenyl)-3-methyl butane, The 2 and 2-screw (4-hydroxyphenyl) -3, 3-dimethyl butane, A 2 and 2-screw (4-hydroxyphenyl)-4-methyl pentane, 1 and 1-screw (4-hydroxyphenyl) - The homopolymer obtained from at least one sort of bisphenols chosen from the group which consists of 3, 3, and 5-trimethyl cyclohexane and alpha, and alpha'-screw (4-hydroxyphenyl)-m-diisopropylbenzene Or a copolymer is desirable and it is homopolymer [ of bisphenol A ] and 1, and 1-screw (4-hydroxyphenyl) especially. - 3, 3, a 5-trimethyl cyclohexane and bisphenol A, A copolymer with 2 and 2-screw {(4-hydroxy-3-methyl) phenyl} propane or alpha, and alpha'-screw (4-hydroxyphenyl)-m-diisopropylbenzene is used preferably.

[0023] As a carbonate precursor, carbonyl halide, carbonate ester, or halo formate is used, and the dihaloformate of a phosgene, diphenyl carbonate, or a dihydric phenol etc. is specifically mentioned.

[0024] If in charge of making the above-mentioned dihydric phenol and a carbonate precursor react with interfacial polymerization or scorification, and manufacturing polycarbonate resin, the antioxidant of a catalyst and a dihydric phenol etc. may be used if needed. Moreover, even if polycarbonate resin is branching polycarbonate resin which copolymerized the polyfunctional aromatic compound of three or more organic functions, it may be polyester carbonate resin which copolymerized the bifunctional carboxylic acid of aromatic series or aliphatic series, and may be the mixture which mixed two or more sorts of the obtained polycarbonate resin.

[0025] The reaction by interfacial polymerization is usually a reaction of a dihydric phenol and a phosgene, and is made to react to the bottom of existence of an acid binder and an organic solvent. As an acid binder, amine compounds, such as alkali-metal hydroxides, such as a sodium hydroxide and a potassium hydroxide, or a pyridine, are used, for example. As an organic solvent, halogenated hydrocarbon, such as a methylene chloride and a chlorobenzene, is used, for example. Moreover, the catalyst of tertiary amines, such as triethylamine, a tetra--n-butyl ammonium star's picture, and a tetra--n-butyl phosphonium star's picture, a quaternary ammonium compound, a quaternary phosphonium compound, etc. can also be used for acceleration of a reaction. It is desirable in that case for reaction temperature to keep pH under reaction at 0-40 degrees C for 10 minutes to about 5 hours, and to usually keep reaction time or more at nine.

[0026] The reaction by scorification is usually an ester exchange reaction of a dihydric phenol and carbonate ester, and it mixes heating a dihydric phenol and carbonate ester under existence of inert gas, and it is performed by the approach of making the mono-hydroxy compound (for example, phenol) to generate distilling. Although reaction temperature changes with boiling points of the mono-hydroxy compound to generate etc., it is usually the range of 120-350 degrees C. A reaction anaphase is made to make easy the distillate of the mono-hydroxy compound which decompressed and generates a system to 10 - 0.1Torr extent. Since the mono-hydroxy compound generated during a reaction remains in polycarbonate resin, sufficient reaction time is needed and reaction time is about 1 - 4 hours.

[0027] As carbonate ester, ester, such as an aryl group of the carbon numbers 6-10 which may be permuted, an aralkyl radical, or an alkyl group of carbon numbers 1-4, is mentioned. Diphenyl carbonate, JITORIRU carbonate, screw (chlorophenyl) carbonate, m-cresyl carbonate, dinaphthyl carbonate, screw (diphenyl) carbonate, dimethyl carbonate, diethyl carbonate, dibutyl carbonate, etc. are specifically mentioned, and diphenyl carbonate is desirable especially.

[0028] A polymerization catalyst can be used in order to speed up a rate of polymerization. Moreover, as this polymerization catalyst For example, a sodium hydroxide, a potassium hydroxide, sodium salt of a dihydric phenol, Alkali metal compounds, such as potassium salt, a calcium hydroxide, a barium hydroxide, Alkaline earth metal compounds, such as a magnesium hydroxide, tetramethylammonium hydroxide, Nitrogen-containing basicity compounds, such as tetraethylammonium hydroxide, a trimethylamine, and triethylamine, The alkoxides of alkali metal or alkaline earth metal, the organic-acid salts of alkali metal or alkaline earth metal, Zinc compounds, boron compounds, aluminium compounds, and silicon compounds The catalyst used for usual esterification reactions, such as germanium compounds, organotin compounds, lead compounds, osmium compounds, antimony compound manganese compounds, titanium compounds, and zirconium compounds, and an ester exchange reaction can be used. A catalyst may be used independently, and two or more sorts may be combined and it may be used. The  $1 \times 10^{-8}$  to  $1 \times 10^{-4}$ Eq of the amount of these polymerization catalysts used is more preferably chosen to the dihydric phenol of one mol of a raw material in  $1 \times 10^{-7}$  to  $5 \times 10^{-4}$ Eq.

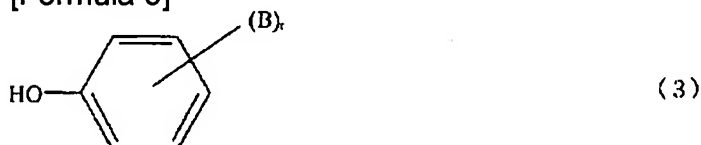
[0029] Moreover, in this polymerization reaction, in order to decrease the end group of phenol nature After the anaphase of a polycondensation reaction, or termination, end halt agents other than monofunctional phenols, For example, screw (chlorophenyl) carbonate, screw (BUROMO phenyl) carbonate, Screw (nitrophenyl) carbonate, screw (phenyl phenyl) carbonate, Chlorophenyl phenyl carbonate, BUROMO phenyl phenyl carbonate, It is desirable to add compounds, such as nitrophenyl phenyl carbonate, phenyl phenyl carbonate, methoxycarbonyl phenyl phenyl carbonate, and ethoxycarbonyl phenyl phenyl carbonate. 2-chlorophenyl phenyl carbonate and 2-methoxycarbonyl phenyl phenyl are desirable, and 2-methoxycarbonyl phenyl phenyl is used especially preferably.

[0030] In the polymerization reaction of the polycarbonate resin by interfacial polymerization, monofunctional phenols are used as an end halt agent. Since the end is blocked by the radical based on monofunctional phenols, the polycarbonate resin which monofunctional phenols were used as an end halt agent for molecular-weight accommodation, and was obtained is excellent in thermal stability compared with the thing without that right.

[0031] As these monofunctional phenols, the monofunctional phenols expressed with following general formula (3) - (5) can be shown.

[0032]

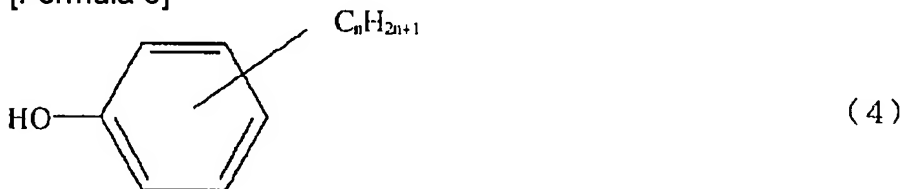
[Formula 5]



[0033] [-- the inside of a formula, and B -- a hydrogen atom, the alkyl group of 1-9 carbon numbers of each alkyl group, or a phenyl alkyl group -- it is -- r -- 1-5, and] that is the integer of 1-3 preferably.

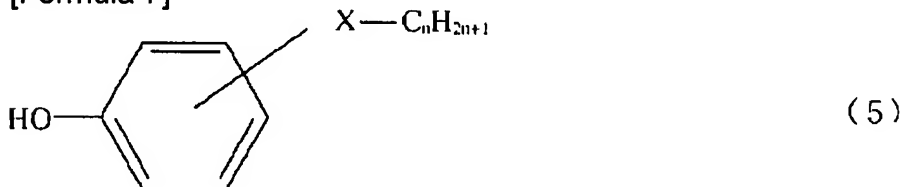
[0034]

[Formula 6]



[0035]

[Formula 7]



[0036] [-- here whose X is -R-O-, -R-CO-O-, or -R-O-CO- among these formulas -- R -- single bond or carbon numbers 1-10, and] the aliphatic hydrocarbon radical of the bivalence of 1-5 is preferably indicated to be, and n indicates the integer of 10-50 to be.

[0037] As an example of monofunctional phenols expressed with the above-mentioned general formula (3), an isopropyl phenol, p-tert-butylphenol, p-cresol, p-cumyl phenol, iso octyl phenol, etc. are mentioned, for example.

[0038] Moreover, the monofunctional phenols expressed with above-mentioned general formula (4) - (5) If it is the phenols which have a long-chain alkyl group or a long-chain aliphatic series ester group as a substituent and the end of polycarbonate resin is blocked using these. These are effective in it not only functioning as an end halt agent or a molecular weight modifier, but the melting fluidity of resin being improved, and there being effectiveness which a fabricating operation not only becomes easy, but makes low the physical properties as a substrate, especially water absorption of resin, and the birefringence of a substrate being reduced, and are used preferably.

[0039] As permutation phenols of the above-mentioned general formula (4), the thing of n of 10-30, especially 10-26 is desirable, and it can mention for example, a DESHIRU phenol, a dodecyl phenol, a tetradecyl phenol, a hexadecyl phenol, an octadecyl phenol, an EIKO sill

phenol, a DOKOSHIRU phenol, a thoria KONCHIRU phenol, etc. as the example.

[0040] Moreover, as permutation phenols of the above-mentioned general formula (5), X is -R-CO-O-, the compound whose R is single bond is suitable, n is suitable for the thing of 10-30, especially 10-26, and for example, hydroxybenzoic-acid DESHIRU, hydroxybenzoic-acid dodecyl, hydroxybenzoic-acid tetradecyl, hydroxybenzoic-acid hexadecyl, hydroxybenzoic-acid ray KOSHIRU, hydroxybenzoic-acid DOKOSHIRU, and hydroxybenzoic-acid thoria KONCHIRU are mentioned as the example.

[0041] The monofunctional phenols expressed with the above-mentioned general formula (3) among these monofunctional phenols are desirable, are the phenols of alkylation or phenyl alkylation more preferably, and are p-tert-butylphenol or p-cumyl phenol especially preferably. Two or more sorts may use it, it being desirable % and to be preferably at least five-mol introduced into a 10 mol % end at least, they being independent as for an end halt agent, or mixing to all the ends of the polycarbonate resin with which the end halt agent of these monofunctional phenols was obtained.

[0042] As for the molecular weight of polycarbonate resin, 10,000-22,000 are desirable at viscosity average molecular weight (M), 12,000-20,000 are more desirable, and 13,000-especially 18,000 are desirable. Reinforcement sufficient as a charge of optical lumber is obtained, and the melting fluidity at the time of shaping is also good, and the polycarbonate resin which has this viscosity average molecular weight generates and has a desirable shaping distortion. The viscosity average molecular weight as used in the field of this invention inserts and asks a degree type for the specific viscosity ( $\eta_{sp}$ ) which asked methylene chloride 100mL for 0.7g of polycarbonate resin from the solution which dissolved at 20 degrees C.

[0043]  $\eta_{sp}/c = [\eta] + 0.45x [\eta]^2 c$  (however,  $[\eta]$  limiting viscosity)

$[\eta] = 1.23 \times 10^{-4} M^{0.83} c = 0.7$  raw-material polycarbonate resin After manufacturing with well-known conventional methods (interfacial polymerization, melting polymerization method, etc.) conventionally, In a solution condition carry out alkali extract and filtration processing, or the granular raw material after granulation (deliquoring) For example, ketones, such as an acetone It is desirable for a polycarbonate poor solvent and non-solvents, such as aliphatic hydrocarbon, such as a hexane, and a xylene, to wash, and to remove impurities and foreign matters, such as a low molecular weight constituent and an unreacted component. [, such as aromatic hydrocarbon, ] Furthermore, it is desirable to remove a foreign matter through the sintered metallic filter of 10 micrometers of filtration accuracies in a melting condition at the extrusion process (pelletizing process) which obtains the pellet type polycarbonate resin for presenting injection molding. It is also desirable to add additives, such as antioxidants, such as release agents, such as for example, polyhydric-alcohol fatty acid ester, and the Lynn system, as occasion demands. Anyway, the raw material resin before injection molding needs to make the content of a foreign matter, an impurity, a solvent, etc. low as much as possible.

[0044] As an approach of reducing the content of the matter expressed with a formula (1) and (2) After addition of the monofunctional phenols and a catalyst are added. For example, fully react or After manufacturing conventionally with well-known conventional methods (a solution polymerization method, melting polymerization method, etc.), It is desirable to carry out an alkali extract, or for a polycarbonate poor solvent and non-solvents, such as aliphatic hydrocarbon, such as ketones, such as an acetone, and a hexane, and a xylene, to wash the granular raw material after granulation (deliquoring), and to remove in a solution condition. [, such as aromatic hydrocarbon, ] As for these approaches and means, it is desirable to carry out [ \*\*\*\* / combining suitably ] until the content of the matter expressed with a formula (1) and (2) is reduced by the target value. If the example is shown, in an acetone extraction, will use it conventionally large quantity, for example, about 10 weight, twice or more than it, extract temperature will be raised conventionally, and approaches, such as stirring the amount used to polycarbonate resin more powerfully than before at the time of an extract, will be mentioned.



[0045] In manufacturing an optical disk substrate from the above-mentioned polycarbonate resin, it uses an injection molding machine (an injection-compression-molding machine is included). Be [ easy although / it ] generally used as this injection molding machine, as the cylinder from a viewpoint which controls generating of carbide and raises the dependability of a disk substrate, or a screw, adhesion with resin is low and it is desirable to use the thing which comes to use the ingredient in which corrosion resistance and abrasion resistance are shown. As conditions for injection molding, the cylinder temperature of 300-400 degrees C and the die temperature of 50-140 degrees C are desirable, and the optical disk substrate which was optically excellent with these can be obtained. The environment in a forming cycle is considered from the object of this invention, and is desirable. [ of a thing clean as much as possible ] Moreover, it also becomes important to dry enough the ingredient with which shaping is presented and to remove moisture, or to consider so that stagnation which causes disassembly of melting resin may not be caused. Furthermore, it is also important for the substrate which abnormalities generated in the birefringence, the mechanical characteristic, etc. to consider so that it may not adopt as a product or a substrate for a trial.

[0046] Even if the optical disk substrate which consists of a polycarbonate resin molding material for optics by this invention carries out an elevated temperature and bottom long duration maintenance of a high-humidity condition, there is very little generating of a minute flake, and it excels as the substrate of the optical disk of the digital versatile disc (DVD) represented with CD-R, CD-RW, MO, a digital videodisc, DVD-ROM, DVD-audio, DVD-R, DVD-RAM, etc., especially a substrate of DVD. the constant temperature by which the property under this elevated temperature and high-humidity condition controlled the disk to the temperature of 80 degrees C, and 85% of relative humidity -- it is checked by investigating flake occurrences with a magnitude [ after leaving it in a constant humidity chamber for 1000 hours ] of 20 micrometers or more. The flake occurrences of the disk obtained from the polycarbonate resin molding material by this invention are two or less per substrate with a diameter of 120mm, and a suitable thing is one or less piece.

[0047]

[Example] Although an example is given and being hereafter explained to a detail, this invention is not limited to this at all. In addition, assessment followed the following approach.

(1) The quantum was performed using the quantitative-analysis high performance chromatography (HPLC) of the matter expressed with a formula (1).

(2) The quantum was performed using the quantitative-analysis high performance chromatography (HPLC) of the matter expressed with a formula (2).

(3) the object for long-term reliability-trial disks -- making machine [Sumitomo -- Heavy industrial machine -- make -- the constant temperature which controlled the substrate for optical disks (1.2mm in the diameter of 120mm, thickness) fabricated by DISK 3M III] to the temperature of 80 degrees C, and 85% of relative humidity -- after leaving it in a constant humidity chamber for 1000 hours, flake occurrences with a magnitude [ in a substrate ] of 20 micrometers or more were counted. This was performed about 25 optical disk substrates, the average was calculated, and this was made into the flake number.

[0048] (4) CD productivity trial injection molding machine, Sumitomo Heavy Industries DISK3 M III It equipped with the stamper for CD made from the nickel with which the pit went the metal mold only for CDs into installation and this metal mold, the molding material was fed into the hopper of a making machine by automatic conveyance, and it fabricated with the cylinder temperature of 330 degrees C, and the die temperature of 65 degrees C continuously. After continuous-molding initiation, when abnormalities arose in a birefringence and a mechanical characteristic, defect substrate production number of sheets increased, and it asked for shaping number of sheets until the defect substrate number of sheets per 100-sheet unit exceeds 10%. By the double pass, the birefringence made to \*\*100nm or less by the radial



camber angle, and the mechanical characteristic made the excellent article criterion of a production substrate less than  $\pm 1.6$  degrees.

[0049] (5) A DVD productivity trial injection molding machine, Sumitomo Heavy Industries DISK3 M III It equipped with the stamper for DVD made from the nickel with which the pit went the metal mold only for DVDs into installation and this metal mold, the molding material was fed into the hopper of a making machine by automatic conveyance, and it fabricated with the cylinder temperature of 375 degrees C, and the die temperature of 112 degrees C continuously, and asked for shaping number of sheets by the same approach as CD productivity trial. the excellent article criterion of a production substrate -- by the double pass, according to the radial camber angle, the birefringence took to  $\pm 100\text{nm}$  or less by the hoop direction camber angle, and the mechanical characteristic took less than  $\pm 0.8$  degrees for less than  $\pm 0.3$  degrees.

[0050] Example 1r is 1 and A part has combined with the para position by tert-butyl. Contained 23 ppm of matter expressed with a formula (1), and r is 1 and A part has combined with the para position by tert-butyl. The matter expressed with a formula (2) to 2 and 2-screw (4-hydroxyphenyl) propane frame polycarbonate powder contained 32 ppm The Lynn system anti-oxidant [tris (2, 4-G t-buthylphenyl) phosphite] After adding 40 ppm and aliphatic series ester (glycerol monostearate) 350ppm, it pelletized with the extruder. The obtained pellet is used and the result of having performed the long-term reliability trial, CD productivity trial, and the DVD productivity trial is shown in a table 1.

[0051] In example 2 example 1, r is 1 and A part has combined with the para position by tert-butyl. Contained 11 ppm of matter expressed with a formula (1), and r is 1 and A part has combined with the para position by tert-butyl. The same actuation as an example 1 was performed except having used 2 and 2-screw (4-hydroxyphenyl) propane frame polycarbonate powder containing 25 ppm of matter expressed with a formula (2). A result is shown in a table 1.

[0052] In example 3 example 1, r is 1 and A part has combined with the para position by tert-butyl. Contained 6 ppm of matter expressed with a formula (1), and r is 1 and A part has combined with the para position by tert-butyl. The same actuation as an example 1 was performed except having used 2 and 2-screw (4-hydroxyphenyl) propane frame polycarbonate powder containing 7 ppm of matter expressed with a formula (2). A result is shown in a table 1.

[0053] In example of comparison 1 example 1, r is 1 and A part has combined with the para position by tert-butyl. Contained 82 ppm of matter expressed with a formula (1), and r is 1 and A part has combined with the para position by tert-butyl. The same actuation as an example 1 was performed except having used 2 and 2-screw (4-hydroxyphenyl) propane frame polycarbonate powder containing 95 ppm of matter expressed with a formula (2). A result is shown in a table 1.

[0054] That the content of the matter expressed with 50 ppm or less and a formula (2) must be reduced to 50 ppm or less has the clear content of the matter expressed with the formula (1) contained in it about the polycarbonate resin molding material for optics with which substrate shaping is presented for obtaining a reliable high density optical disk substrate from this result.

[0055]

[A table 1]

	式(1)で 表される 物質の含有量 [ppm]	式(2)で 表される 物質の含有量 [ppm]	白点発生数 [ヶ/枚]	CD 連続成形 枚数	DVD 連続成形 枚数
実施例1	23	32	0.6	178200	151800
実施例2	11	25	0.2	267600	220800
実施例3	6	7	0.1	323400	291100
比較例1	82	95	5.4	39400	27300

[0056]

[Effect of the Invention] According to the molding material of this invention, the polycarbonate resin molding material for optics and optical disk substrate which there can be few contents of the matter by which the content of the matter which it contains, i.e., is expressed with the following formula (1) which is among this ingredient is expressed with 50 ppm or less and a formula (2) as 50 ppm or less, and can maintain high dependability over a long period of time, and can improve substrate productivity can be obtained. Also in optical disks, such as CD-R, CD-RW, MO, and a digital versatile disc (DVD), especially DVD, the effectiveness which does so is a thing according to rank.

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[Translation done.]

## \* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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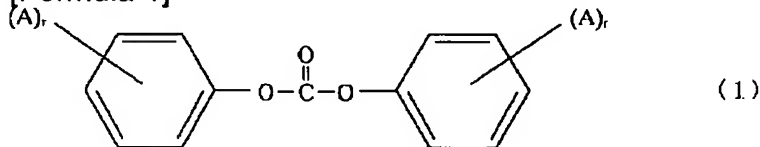
CLAIMS

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[Claim(s)]

[Claim 1] The polycarbonate resin molding material for optics which consists of polycarbonate resin whose content of the matter expressed with a formula (2) the content of the matter expressed with a formula (1) is 50 ppm or less, and is 50 ppm or less.

[Formula 1]



[A is a hydrogen atom, an alkyl group, a phenyl alkyl group, or an aliphatic series ester group among a formula, and r is the integer of 1-5.]

[Formula 2]



[A is a hydrogen atom, an alkyl group, a phenyl alkyl group, or an aliphatic series ester group among a formula, and r is the integer of 1-5.]

[Claim 2] Polycarbonate resin is a polycarbonate molding material for optics according to claim 1 whose viscosity average molecular weight is 10000-22000.

[Claim 3] It is the polycarbonate resin molding material for optics according to claim 1 whose A is the alkyl group of 1-9 carbon numbers or phenyl alkyl group of each alkyl group among a formula (1) and whose r is the integer of 1-5.

[Claim 4] It is the polycarbonate resin molding material for optics according to claim 1 whose A is the alkyl group of 1-9 carbon numbers or phenyl alkyl group of each alkyl group among a formula (2) and whose r is the integer of 1-5.

[Claim 5] The optical disk substrate formed from the polycarbonate resin molding material for optics according to claim 1.

[Claim 6] The optical disk substrate for digital versatile discs (DVD) formed from the polycarbonate resin molding material for optics according to claim 1.

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[Translation done.]